WHAT IS CLAIMED IS:

1. A method of processing a specimen comprising:

a first step of etching ~~the~~ a specimen which is a lamination layer ~~which is~~ formed on a substrate and includes at least one layer made of NiFe alloy or NiFeCo alloy, by gas plasma with a gas which contains chlorine at a temperature of the specimen below 200°C in an etching chamber;

a second step of removing a residual chlorine component deposited on an exposed portion of said lamination layer during said first step, and eliminating debris deposited on a side wall thereof by rinsing the same using at least one liquid; and

a third step of drying the specimen after rinsing thereof.

2. A method of processing a specimen according to claim 1, wherein said second step is executed continuously after said first step.

3. A method of processing a specimen according to claim 1, wherein said gas plasma is generated using at least one of Cl_2, BCl_2, Ar and O_2 gases, or ~~in~~ a combination thereof.

4. A method of processing a specimen according to claim 1, wherein said second step of liquid rinsing includes one or more than two of the following steps:

(A) pure water rinsing,

(B) alkaline liquid cleaning followed by water rinsing,

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(C) acidic liquid cleaning followed by water rinsing,

(D) fluorine nitric acid cleaning followed by water rinsing,

(E) neutral detergent cleaning followed by water rinsing.

5. A method of processing a specimen according to claims 1 or 2, wherein said third step of drying is executed at a temperature below 200°C.

6. A method of processing a specimen according to claim 1, wherein a temperature of said liquid is controlled.

7. A method of processing a specimen according to claim 1, wherein said lamination layer includes, in addition to said NiFe or NiFeCo alloys, at least one or more of the following layers which are to be etched by gas plasma in said process chamber:

(A) photo resist layer,

(B) alumina (Al2O3) layer,

(C) silicon oxide layer,

(D) Cu layer,

(E) Ta layer, and

(F) Cr layer.

8. A method of processing a specimen according to claim 1, wherein said substrate is a sintered substrate comprising Al_2O_3 and TiC, and on said substrate a layer of NiFe or NiFeCo alloy is formed, which is to be etched in said process chamber.

9. An apparatus for processing a specimen which is laminated on a substrate, comprising:

an etching process unit which is supplied with a gas to produce plasma, for etching ~~said~~ specimen laminated on ~~said~~ substrate having two or more layers, at least one of which comprises NiFe or NiFeCo alloy, at a temperature of said specimen below 200°C;

a rinsing unit for rinsing an exposed surface of said lamination layer comprising said NiFe alloy, which is exposed by said etching, using a liquid; and

a dryer unit for drying said exposed surface of said lamination layer comprising said NiFe alloy after rinsing thereof, wherein said lamination layer comprising said NiFe alloy which is dried is further subjected to gas plasma etching.

10. An apparatus for processing a specimen according to claim 9, further comprising:

an atmospheric loader;

a vacuum transport chamber having a vacuum transport robot therein; and

~~an~~ unload and ~~a~~ load lock chambers connecting between said atmospheric loader and said vacuum transport chamber for delivering the specimen, wherein

said vacuum transport chamber is connected to said etching process chamber of said apparatus, and

said atmospheric loader is connected to a rinsing cup, hot plate and the like provided in said rinsing/dryer unit.

11. An apparatus for processing a specimen according to claim 9, wherein ~~said~~ etching process ~~chamber is~~ chambers are provided. ~~in a plural number.~~

12. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto and including a multiple layer resist etching thereof, comprising the steps of:

forming a lamination layer comprising an upper photo resist layer, a hard mask layer made of SiO_2 or alumina, a lower photo resist layer, and a seed layer made of NiFe or NiFeCo alloy;

plasma-etching said hard mask layer using said upper photo resist layer as its mask;

plasma-etching said lower photo resist layer to form a deep groove therein using a gas which contains chlorine with said hard mask used as its mask until said seed layer is exposed in the bottom of said deep groove;

removing a residual chlorine component deposited on an exposed surface of said seed layer by rinsing with a liquid;

drying after removal of said residual chlorine component; and

embedding NiFe alloy into said deep groove to connect with said seed layer thereby forming said upper magnetic pole.

13. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto

and including a seed layer processing thereof, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy connected to said seed layer, a gap layer made of an oxide such as alumina, silicon oxide or the like in close contact with said seed layer, and a shield layer made of NiFe alloy in close contact with said gap layer;

plasma-etching said seed layer using a gas which contains chlorine with said upper magnetic pole used as its mask; and

removing a residual chlorine component by liquid rinsing.

14. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto and including a gap layer processing thereof, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy connected to said seed layer, a gap layer made of an oxide film in close contact with said seed layer, and a shield layer made of NiFe alloy in close contact with said gap layer;

etching said seed layer;

etching said gap layer by plasma processing using a gas which contains chlorine or fluorine with said upper magnetic pole used as its mask; and

removing a residual chlorine and/or fluorine components by liquid rinsing.

15. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto and including a trim-processing thereof, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy connected to said seed layer, a gap layer made of an oxide film in close contact with said seed layer, and a shield layer made of NiFe alloy in close contact with said gap layer;

etching said seed layer;

etching said gap layer;

trim-etching said shield layer using a gas which contains chlorine by plasma processing with said upper magnetic pole used as its mask; and

removing a residual chlorine component by liquid rinsing.

16. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite thereto, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy connected to said seed layer, a gap layer made of an oxide film in close contact with said seed layer, and a shield layer made of NiFe alloy in close contact with said gap layer;

plasma-etching said seed layer, said gap layer and said shield layer consecutively with said upper magnetic pole used as a mask; and

applying a corrosion prevention treatment for removal of

a residual chlorine component deposited on an etched surface thereof.

17. A method of manufacture of a magnetic head according to claim 18, wherein said gap layer is etched by gas plasma containing fluorine, said seed layer and said shield layer are etched by gas plasma containing chlorine and argon, and wherein said corrosion prevention treatment is carried out by liquid rinsing.

18. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite to each other, comprising the steps of:

forming a lamination layer comprising a seed layer made of NiFe or NiFeCo alloy, an upper magnetic pole made of NiFe alloy connected to said seed layer, a gap layer made of an oxide film in close contact with said seed layer, and a shield layer made of NiFe alloy in close contact with said gap layer;

plasma-etching said seed layer and said gap layer consecutively with said upper magnetic pole used as a mask; and subsequently,

applying a corrosion prevention treatment for removal of a residual chlorine component deposited on an etched surface thereof.

19. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite to each other for manufacturing said upper magnetic pole thereof,

comprising the steps of:

forming a lamination layer comprising an upper magnetic pole layer made of NiFe alloy, and a mask layer of a photo resist or an oxide film made of alumina or silicon oxide film which is laminated on said upper magnetic pole;

plasma etching said upper magnetic pole using said mask layer as its mask; and then

applying a corrosion prevention treatment for removal of a residual chlorine component deposited on an etched surface thereof.

20. A method of manufacture of a magnetic head having an upper magnetic pole and a lower magnetic pole disposed opposite to each other and including a process for manufacture of said upper magnetic pole thereof, comprising the steps of:

forming a lamination layer comprising, sequentially from above,

(A) a photo resist film,

(B) an oxide film layer made of alumina, silicon oxide or the like,

(C) an upper magnetic pole layer made of NiFe alloy,

(D) a seed layer made of NiFeCo alloy for bonding said NiFe alloy,

(E) a gap layer made of an oxide film such as alumina, silicon oxide or the like, and

(F) a shield layer made of NiFe alloy;

carrying out the following plasma etching steps

continuously,

(Step 1) etching said oxide film layer using said mask layer as its mask,

(Step 2) etching said upper magnetic pole layer using said oxide film layer as it mask,

(Step 3) etching said seed layer using said upper oxide film layer or said upper magnetic pole layer as its mask,

(Step 4) etching said gas layer using said upper oxide film layer and said upper magnetic pole layer as its mask, and

(Step 5) trim-etching said shield layer using said upper oxide film layer and said upper magnetic pole layer; and after that,

applying a corrosion prevention treatment for removing a residual chlorine component deposited on an etched surface thereof.

21. A method of manufacture of a magnetic head according to claim 19, comprising carrying out any steps of said plasma etching steps 1-5 continuously, then applying said corrosion prevention treatment for removal of the residual chlorine component deposited on the etched surface thereof.

22. A method of manufacture of a magnetic head according to claim 20, comprising carrying out a rinsing/drying process for each step of said plasma etching steps 1-5 for removing a residual chlorine component and a debris on a side wall, said rinsing/drying process being executed continuously within a

single unit.

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23. A method of manufacture of a magnetic head according to claim 20, wherein, in order for a selectivity ratio between each mask and its under-layer to become large during each plasma etching step, said etching process (1) is executed using a gas which contains mainly BCl_3 or fluorine, said etching processes (2) and (3) are executed using a gas which contains mainly chlorine, said etching process (4) is executed using a gas which contains mainly BCl_3 or fluorine, and said etching process (5) is executed using a gas which contains mainly chlorine, respectively.